and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 303 — PIPE CULVERTS

303.01 DESCRIPTION. This work shall consist of placing the size and type of pipe on a firm bed to the specified line and grade and cleaning the existing pipes as specified in the Contract Documents or as directed by the Engineer.

303.02 MATERIALS.

Selected Backfill	302.02
Concrete Mix No. 2	902.10
Pipe	905

303.03 CONSTRUCTION. Pipe lengths and gradients shall be verified by the Contractor and shall be acceptable to the Engineer before installation.

End walls, when visible from the roadway, shall be constructed parallel to the roadway and askew pipe shall protrude through the end wall. End walls, not visible from the roadway, shall be constructed normal to the center line of the pipe.

The existing pipes shall be cleaned and the material disposed of as directed by the Engineer.

303.03.01 Excavation. When a pipe is to be laid on existing ground, on or under fill, embankment shall be constructed to a height of at least 9 in., but not more than 3 ft above the proposed top of the pipe. The trench shall then be excavated to receive the pipe. The width of trench shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe. This width shall be twice the outside diameter of the pipe or the outside diameter plus 18 in. on each side, whichever is less. Refer to 402.03.01 for excavated material.

303.03.02 Bedding. When rock is encountered, it shall be removed and replaced with a minimum 8 in. of selected backfill as directed by the Engineer.

When unsuitable foundation material is encountered, it shall be removed and replaced with selected backfill for the full width of the trench as directed by the Engineer.

Culverts 48 in. or more in nominal horizontal diameter shall be bedded in an approved foundation shaped by means of a template which will support the pipe for at least 10 percent of its overall height.

303.03.03 Installation. Pipes shall be laid with hubs upgrade. A single lay hole through the shell of the pipe will be permitted with an approved lifting device. The lay hole shall be cast in the pipe during fabrication or cored without damaging any reinforcement. After installation, the lay hole shall be permanently sealed by filling with mortar, rubber plug, or other means approved by the Engineer. Wood plugs are prohibited.

303.03.04 Joints. Pipe joints shall be sealed in a manner appropriate to the pipe material.

Reinforced Concrete Pipe. Joints shall be sealed with rubber type gaskets (circular pipe) or resilient type material (elliptical pipe) conforming to M 198. Mortar joints are prohibited.

Metal Pipe. Joints shall be sealed with rubber gaskets and coupling bands conforming to M 36.

Plastic Pipe. Joints shall be integral bell and spigot with rubber or neoprene gaskets conforming to F 477.

303.03.05 Pipe Connections. Pipe connections may be either prefabricated or constructed in the field. Corrugated pipe sections shall be butted together and the sections joined with an approved band. A field pipe connection shall include cutting a hole in one pipe, inserting and trimming the connecting pipe and placing a concrete collar using Concrete Mix No. 2 at the connection. In the case of corrugated pipes, a welded connection may be substituted for the concrete collar.

303.03.06 Pipe Encasement. When specified in the Contract Documents or when directed by the Engineer, pipes shall be encased using Concrete Mix No. 2.

303.03.07 Backfill. Earth for backfill shall be free from large lumps, clods, and rocks and shall be placed along the side of the pipe for the full width of the trench in layers not exceeding 6 in. uncompacted depth. Compaction shall conform to Section 210. Each layer shall be compacted simultaneously on both sides of the pipe by means of an approved mechanical tamper. Special care shall be taken to compact the backfill thoroughly under the haunches of the pipe. This method of filling and compaction shall continue until the backfill is completed to a minimum height of 9 in. above the top of pipe. The Contractor shall protect all pipe from damage due to construction equipment or other vehicular traffic passing over the pipe.

Backfill may be placed immediately after laying the pipe, provided that all joints have been sealed as specified.

303.03.08 Removal of Existing Pipe Culverts. When specified in the Contract Documents, existing pipe culverts shall be removed and become the property of the Contractor. Backfilling of trenches resulting from pipe removal shall conform to Section 210.

303.03.09 Relaying Existing Pipe. When specified in the Contract Documents, removed culverts shall be salvaged and relaid in conformance with these Specifications relating to new pipe.

303.03.10 Abandoned Pipes. When specified in the Contract Documents or when directed by the Engineer, abandoned pipes shall be plugged using Concrete Mix No. 2 or brick masonry.

303.04 MEASUREMENT AND PAYMENT. The payment for the items specified in the Contract Documents will be full compensation for all applicable excavation, sheeting, shoring, dewatering, hauling, invert paving, storing, rehandling of material, removal and disposal of excess and unsuitable material, tamped fill, forming bed or foundation, backfill, compaction and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

303.04.01 New pipe culverts will be measured complete in place and paid for at the Contract unit price per linear foot. When a new pipe is to be installed at the same location as an existing pipe, the cost of removal and disposal of the existing pipe, including end walls and end sections, will not be measured but the cost will be incidental to the Contract price of new pipe.

303.04.02 Pipe Connections and Elbows will be measured and paid for at the Contract unit price per each. No deduction from the pipe measurement will be made for pipe connections.

303.04.03 Excavation required below the planned elevation will be measured and paid for as specified in 301.04.

303.04.04 Removal of Existing Pipe will be measured and paid for per the total number of linear feet removed, regardless of the condition. When a multiple pipe installation is removed, each pipe will be measured and paid for. End walls, end sections, etc. removed with the pipe will not be measured but the cost will be incidental to the Contract price.

303.04.05 Selected backfill will be measured and paid for as specified in Section 302.

303.04.06 Relaid Existing Pipe Culverts-Any Size will be measured and paid for as specified in 303.04.01 unless otherwise specified in the Contract Documents.

303.04.07 New end walls, end sections, etc., will be measured and paid for as specified in Section 305.

303.04.08 Removal of existing headwalls, end sections, etc., that are not incidental to the Contract price for the respective pipe items will be measured and paid for as specified in Section 207.

303.04.09 Encasement concrete, and concrete or brick masonry to plug existing pipes will be measured and paid for at the Contract price for the pertinent Concrete Mix No. 2 for Miscellaneous Structures, or Brick Masonry for Miscellaneous Structures item.

303.04.10 Clean Existing Pipe Any Size will be measured and paid for at the Contract unit price per linear foot.

SECTION 304 — STRUCTURAL PLATE PIPE AND STRUCTURAL PLATE PIPE ARCH CULVERTS

304.01 DESCRIPTION. This work shall consist of furnishing and installing structural plate pipe and structural plate pipe arch culverts that are composed of curved plates bolted together in the field as specified in the Contract Documents or as directed by the Engineer.

304.02 MATERIALS.

Selected Backfill	302.02
Concrete Mix No. 2	902.10
Structural Plate for Pipe and Pipe Arches	905

304.03 CONSTRUCTION.

304.03.01 Fabrication. The plates, including required holes, shall be shop fabricated to the required dimensions. The plates shall be shipped complete with proper markings and include all necessary connection devices such as bolts, nuts and washers. The Contractor shall provide working drawings, including erection diagrams and strutting tables acceptable to the Engineer. Erection diagrams shall include proposed lengths and lifting locations of preassembled sections. Fabrication shall not be performed until working drawings are approved by the Engineer.